

DN8657S

16-Bit Shift Register Latch Constant Current Driver IC

Overview

The DN8657S is a semiconductor integrated circuit which incorporates a 16-bit shift register, a latch driver and a constant current driver to satisfy the demand for equalization of LED panel brightness. It also incorporates the serial-in and serial-out/parallel-out functions.

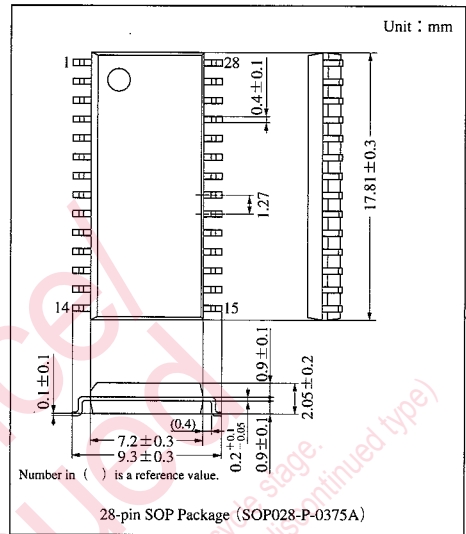
It employs the Bi-CMOS process : The 16-step shift register block and latch block consist of CMOS while the 16-step parallel driver block is bipolar.

Features

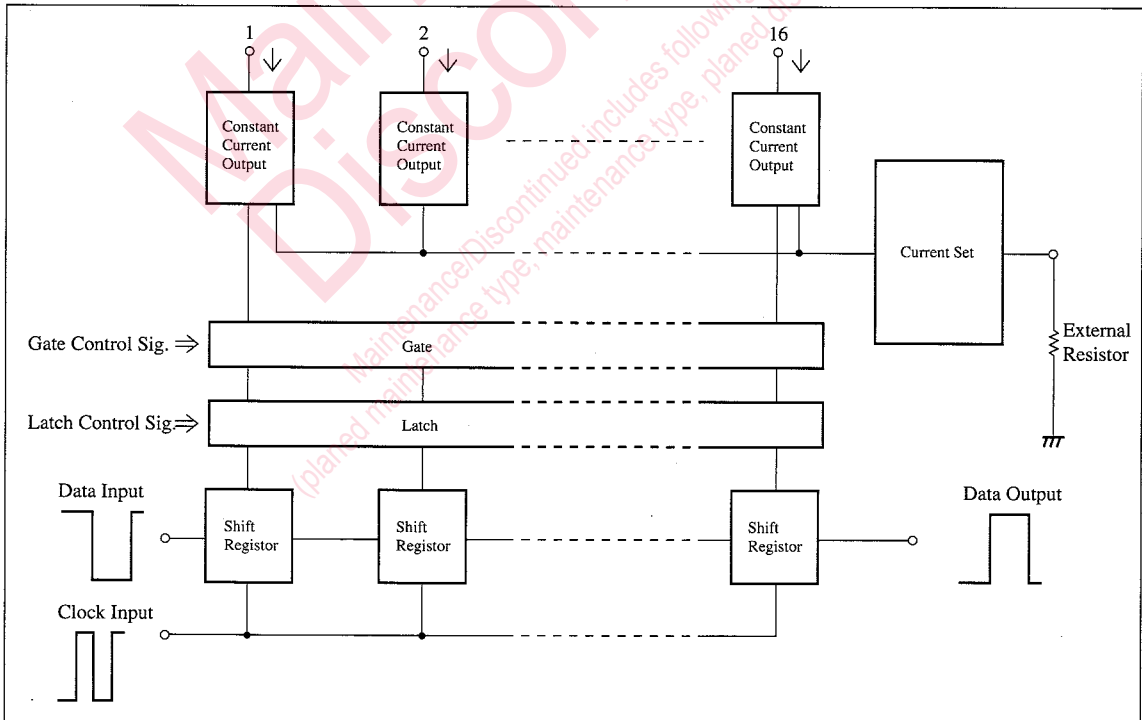
- Serial-in, serial-out/parallel-out
- Cascade connection possible
- Constant current output (0 to 30 mA able to be set by one external resistor)
- Output-forced ON/OFF terminal attached (ENA, ENB)
- Input/Output CMOS compatible

Application

- LED panel drive



Block Diagram



Absolute Maximum Rating (Ta=25°C) Note 1)

Parameter	Symbol	Rating	Unit
Supply voltage	V _{CC}	0 to +7.0	V
Input voltage	V _I	0 to V _{CC}	V
Output voltage <small>Note 1)</small>	V _O	0 to +30	V
Output current	I _O	40	mA
Single unit IC power dissipation	P _D	0.892	W
Reference printed board mounting power dissipation <small>Note 2)</small>		1.333	
Operating ambient temperature	T _{opr}	-20 to +85	°C
Storage temperature	T _{stg}	-55 to +150	°C

Note 1) When output is off

Note 2) for reference printed board SM (glass epoxy printed board : 50×50×1.2 mm).
it decreases with rate of 10.7 mW/°C from Ta = 25 °C.

Recommended Operation Range (Ta=25°C)

Parameter	Symbol	Range
Operating supply voltage	V _{CC}	4.5V to 5.5V

Electrical Characteristics (V_{CC}=5V, Ta=25±2°C)

Parameter		Symbol	Condition	min	typ	max	Unit		
Input voltage	Positive direction	V _{T+}	$\begin{cases} V_{SOUT}=0.1, V_{CC}=0.1V \\ I_{SOUT}=20\mu A \end{cases}$	0.35V _{CC}	—	0.7V _{CC}	V		
	Negative direction	V _{T-}	$\begin{cases} I_O(\overline{Qn})=10\mu A, 22mA \\ V_O(\overline{Qn})=1.0V, I_{ref}=-12mA \end{cases}$	0.2V _{CC}	—	0.55V _{CC}	V		
Input current		I _{IH}	V _{IH} =5.0V	—	—	25	μA		
		I _{IL}	V _{IL} =0V	—	—	-25	μA		
Output voltage (SOUT)		V _{OH}	V _{CC} =5.0V, I _{OH} =-0.4mA	4.0	—	—	V		
		V _{OL}	V _{CC} =5.0V, I _{OL} =1.6mA	—	—	0.5	V		
Output current		I _O	V _O (\overline{Qn})=0.8V	—	—	30	mA		
Output current error between bits		ΔI _O	V _{CC} =5.0V, I _{ref} =-12mA V _O (\overline{Qn})=1.0V	—	—	±10	%		
Output leak current		I _{OLK}	V _O =30V (Output OFF)	—	—	50	μA		
		I _{OLK}	V _O =15V (Output OFF)	—	—	25	μA		
Supply current		I _{CC1}	V _{CC} =5.5V	I _{ref} =0mA	—	—	6	mA	
		I _{CC2}			I _{ref} =-12mA	—	—	45	mA
		I _{CC3}			I _{ref} =-12mA	—	—	55	mA

Electrical Characteristics (V_{CC}=5V, Ta=25±2°C)

Parameter	Symbol	Input	Output	Condition	min	typ	max	Unit
Maximum clock frequency	f _{max}	CLK			10	—	—	MHz
Transmission delay time	t _{PLH}	CLK	SOUT	V _{CC} =5.0V R _L =100Ω C _L =15pF	—	—	100	ns
	t _{PHL}				—	—	100	ns
	t _{PLH}	CLK	\overline{Qn}		—	—	250	ns
	t _{PHL}				—	—	250	ns
	t _{PLH}	ENA ENB	\overline{Qn}		—	—	250	ns
	t _{PHL}				—	—	250	ns
	t _{PLH}	STB	\overline{Qn}		—	—	250	ns
	t _{PHL}				—	—	250	ns

Others

■ Recommended Operation Conditions (Ta = -20 ~ +85°C)

Parameter		Symbol	Condition	min	typ	max	Unit
Supply voltage		V _{CC}		4.5	5.0	5.5	V
Output voltage		V _O		—	—	30	V
Input voltage		V _I		0	—	V _{CC}	V
Clock frequency		f _{CLK}	Input Duty 40 to 60%	—	—	10	MHz
Input pulse width	CLK	t _w		40	—	—	ns
	STB			40	—	—	ns
Setting-up time	SIN	t _{su}		30	—	—	ns
	STB			40	—	—	ns
Hodling time	SIN	t _h		20	—	—	ns
	STB			10	—	—	ns
Clock pulse rise time		t _r		—	—	500	ns
Clock pulse fall time		t _f		—	—	500	ns
Output current	Q _n	I _{OUT} (Note)		—	—	30	mA
	SOUT	I _{OH}		—	—	-0.4	mA
		I _{OL}		—	—	1.6	mA

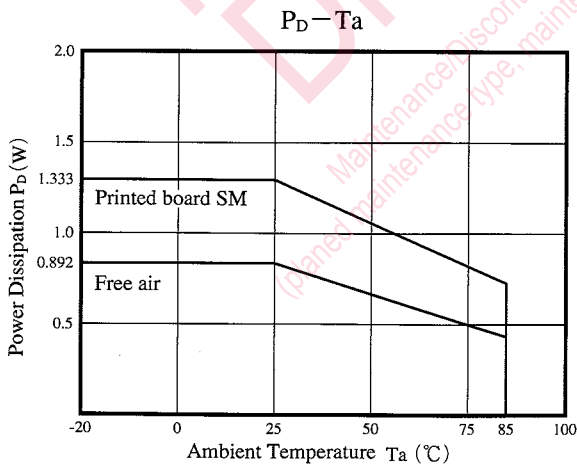
Note) Allowable value is changed, depending on the number of simultaneous ON circuits and duty.
The power dissipation should be reviewed enough for use of DN8657S

■ Function Table (Note)

Input					Output			
CLK	STB	ENA	ENB	SIN	Q ₀	Q _m	Q ₁₅	SOUT
↑	H	L	H	Q _n	Q _n	Q _{m-1}	Q ₁₄	Q ₁₄
↑	L	L	H	Q _n	nc	nc	nc	Q ₁₄
↑	×	H	×	Q _n	L	L	L	Q ₁₄
↑	×	L	L	Q _n	H	H	H	Q ₁₄
↓	×	×	×	Q _n	nc	nc	nc	nc

(Note)
H : High level,
L : Low level,
× : H or L
Q_m, Q_n : H or L.
However, for Q_n, "H" = OFF, "L" = ON.
↑ : Shift from L to H,
↓ : Shift from H to L
nc : No change

■ Package Power Dissipation



(Note) For SM to printed board (glass epoxy printed board : 50×50×1.2mm).
it decreases with rate of 10.7mW/°C from Ta=25°C.
For free air,
it decreases with rate of 7.1mW/°C from Ta=25°C.

Pin Descriptions

Pin No.	Symbol	Pin name	Description
1	DGND	Digital ground	Digital ground
2	SIN	Serial data input	It is the serial data input terminal for shift register.
3	CLK	Clock input	The value of shift register shifts at the rising edge of clock input.
4	STB	Strobe input	Setting the STB input to "H" forwards the data of shift register to the latch. When the STB input is set to "L", even if the value of shift register changes, the value of latch is not changed.
5	NC	NC	
6, 7, 8, 9 11, 12, 13 14, 15, 16 17, 18, 20 21, 22, 23	\overline{Qn}	Driver output	It outputs signals by using the polarity opposite to that of data taken into the latch. For example, when the value of serial input is "H", the output becomes "L" level and the output is turned on. The output takes open collector form of NPN transistor.
10, 19	PGND	Output ground	Output ground
24	ENB	Enabling input B	When the ENA input is set to "H", all the outputs are turned on, independent of condition of ENB input. "H" or "L." Setting the ENA input and ENB input to "L" at the same time, all the outputs are turned off. Setting the ENA input to "L" and the ENB input to "H" prevents the enabling function from activating and allows the data to be outputted.
25	ENA	Enabling input A	
26	SOUT	Serial data output	It is the terminal which performs the serial-output of data inputted from the SIN.
27	RC	Constant current setting input	It connects the external resistor between RC and GND and sets the current of output block. * Output current calculation : $I_o (\overline{Qn}) \doteq \frac{5 \times V_{CC} (V)}{4 \times R_{RC} + 100 (\Omega)}$ ** RC terminal setting calculation : $I_{RC} \doteq \frac{V_{CC} (V)}{2 \times R_{RC} + 50 (\Omega)} \quad \text{or} \quad R_{RC} \doteq \frac{1}{2} \left(\frac{V_{CC} (V)}{I_{RC} (A)} - 50 \right)$
28	V _{CC}	Supply voltage	Supply terminal

* Calculation example

$$V_{CC}=5V \quad I_o (\overline{Qn}) \doteq \frac{5 \times 5}{4 \times 183 + 100} \doteq 30mA$$

$$R_{RC}=183 \Omega$$

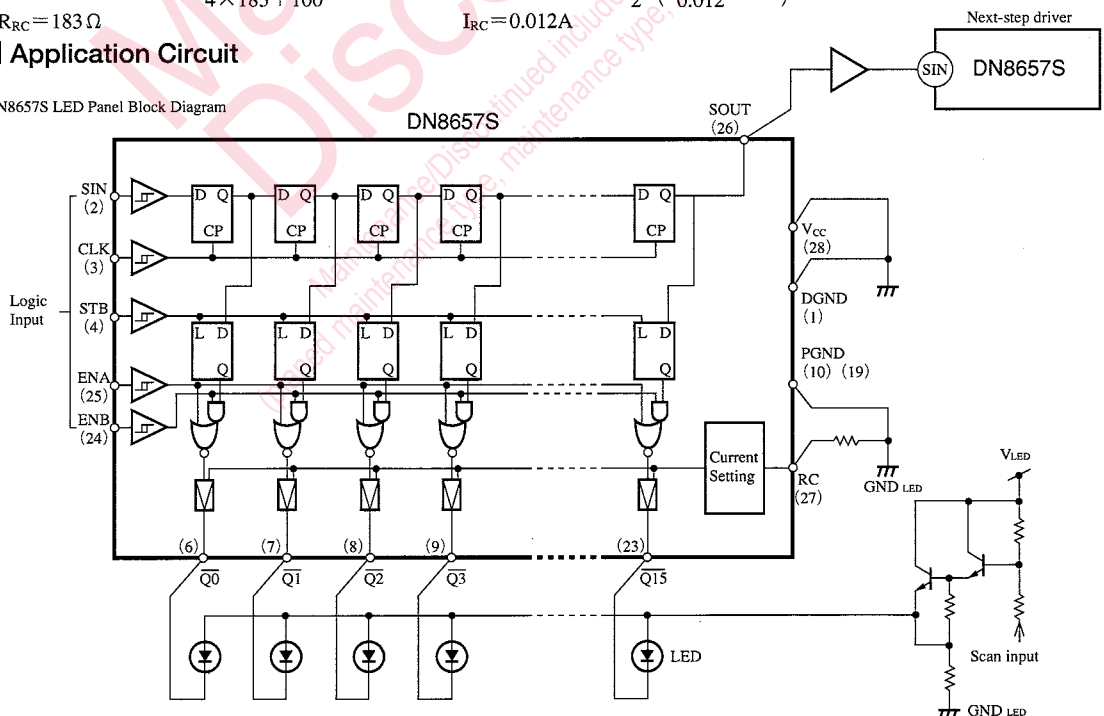
** Calculation example

$$V_{CC}=5V \quad R_{RC} \doteq \frac{1}{2} \left(\frac{5}{0.012} - 50 \right) \doteq 183 (\Omega)$$

$$I_{RC}=0.012A$$

Application Circuit

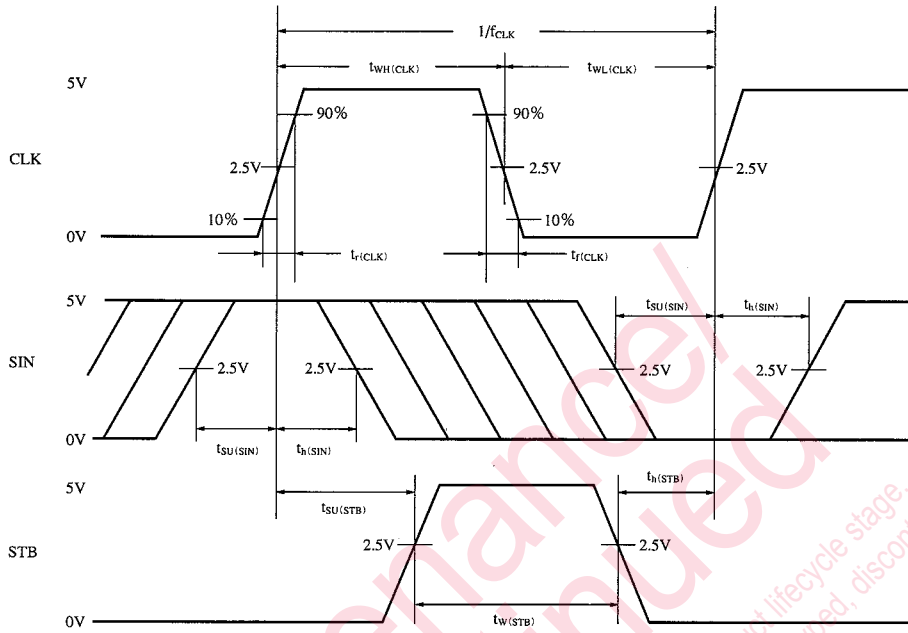
DN8657S LED Panel Block Diagram



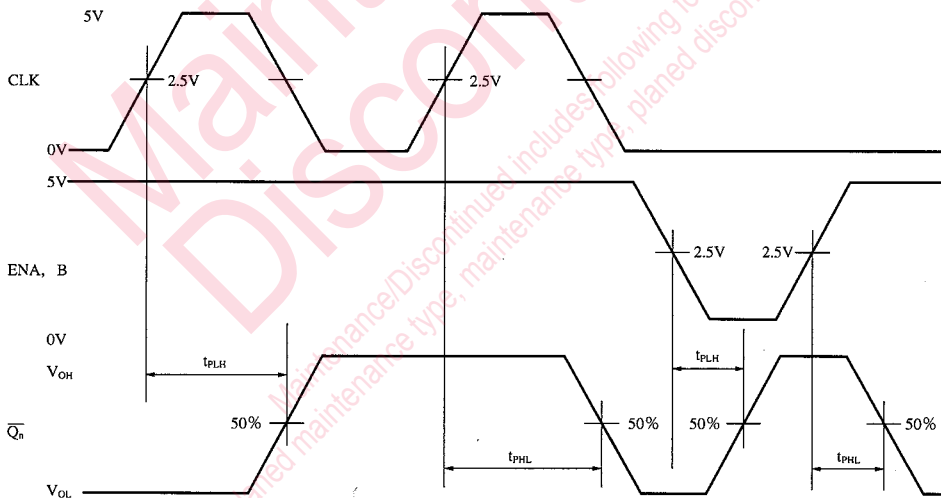
Others

■ Timing Chart

1. Input timing ($V_{IL}=0V, V_{IH}=5.0V$)



2. Transmission delay time ($V_{IL}=0V, V_{IH}=5.0V$)



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